Introduction

Bill Gates states, “The two technologies that will shape the next century are biotechnology and information technology.” With the advent of modern science and technology, biotechnology has emerged as a very prominent field of study and application of modern technology. Biotechnology, contrary to common perception, is not a new development. Since 12,000 BC humans have genetically modified organisms through cross-breeding or selective breeding, except today, modern technology allows humans to directly modify and alter the genetic material of an organism. Biotechnology, according to the United Nations Convention on Biological Diversity of 1992, is any technological application that uses biological systems, living organisms, or derivatives thereof, to make or modify products or processes for specific use. With the recent developments in biological engineering and science, biotechnology has been applied mostly in the agricultural, pharmaceutical, and industrial sectors of society, and has helped the sustainable development of societies through the creation of unique biofuels and foods that were previously inaccessible. The specific applications of biotechnology will be further explored in the background information section.

Despite the unique merits that biotechnology provides us with today, there are many concerns that follow excessive biotechnology use. Scientists and those who use biotechnology commercially must anticipate the technology’s potential harms and benefits and whether such side effects would spread to the environment or ecosystems abroad when the GMO is exported. There are many risks that concern scientists, which will further be specified in the background information section. Addressing these issues should be the focus of the agenda.

Definition of Key Terms

Biotechnology: Technology of exploiting and manipulating biological processes of organisms for industrial, agricultural, or other purposes, often includes the production of certain hormones, antibiotics, etc.

Biosafety: The application of knowledge, techniques and equipment to prevent personal, laboratory and environmental exposure to potentially infectious agents or biohazards

GMO: Genetically modified organisms (GMO) are derived from organisms whose genetic material, or DNA, is modified through genetical engineering and cannot be derived naturally.
GMOs include both GM crops and GM food: GM crops can be indicated as GMO’s stage of cultivation and GM food as a stage of commercialization.

**Genetic Engineering:** Genetic engineering is a process altering the organism’s genetic structure by removing or adding DNA. In history, this process was done by controlled or selective breeding of plants or animals. Currently, the use of modern technology enables faster and more natural methods to target specific genes directly from one organism and alter it.

**Industrial biotechnology:** Biotechnology that applies the techniques of modern molecular biology to improve the efficiency and reduce the environmental impacts of industrial processes like textile, paper and pulp, and chemical manufacturing.

**Biosafety Levels:** In the laboratories, biosafety levels (BSLs) are decided depending on the level of risks perceived to be associated with biologically harmful material.

**Biodiversity:** Biological diversity or biodiversity refers to the variety of life on Earth. The number of species of plants, animals, organisms, genes in species, different environment on the plant (desert, coral reef, or rainforest), are all forms of biodiversity.

I’ll be including other terms as I write the other parts of the report and talk about words that may not be familiar to the delegates.

**Background Information**

**Application of Biotechnology**

The increased use of modern biotechnology has affected our daily lives significantly. Specifically, biotechnology has been widely used for agricultural, industrial, and medicinal purposes. In the agricultural sector, biotechnology is commonly used to produce genetically modified organisms, or GMOs. These GMOs often develop immunity to certain diseases that hurt crop yields, are modified to have favorable traits that make the crop more appetizing or larger in size. In the industrial sector, biotechnology has been utilized to modify the genetic composition and ferment certain plants and sugars for the creation of biofuel, which could be a viable alternative to other energy sources. Biotechnology has also been utilized to produce bioplastics and synthetic polymers that are used in everyday life. Finally, in the pharmaceutical industry, “knowledge of the genetic makeup of our species, the genetic basis of heritable diseases, and the invention of technology to manipulate and fix mutant genes” through biotechnology has helped the production of useful medicine. Furthermore, quite intuitively, the modification of certain genes, bacteria, or microorganisms would help the production and development of vaccines and antibiotics used to combat diseases.

**Biosafety Concerns with the Advent of Biotechnology**
Modern biotechnology is definitely an invaluable scientific development that will help the world’s sustainable development. Nevertheless, the technology also has its side effects on biosafety as it could be detrimental to the biodiversity, human health, as well as the environment. To achieve true sustainable development, certain goals and guidelines regarding biosafety and biotechnology must be fulfilled. The effects of the application of biotechnology must be predictable. The most common of these concerns include the following. There are risks to animal human health due to the irregular genetic makeup of certain organisms. Furthermore, GMOs might invade into ecosystems since the GMOs might become predominant in the ecosystem, there is an invasion in gene flows, and the biodiversity would thus be affected. Additionally, biotechnology can cause horizontal gene transfer. Horizontal gene transfer is the transfer of genetic material from one organism to another organism which is not its offspring. It remains the biggest concern associated with GM crops. This is caused by gene pollution through pollen or seed dispersal and the generation of new line viruses by recombination of genes. There are other minor concerns regarding GM crops effect on the environment like soil fertility due to the chemicals that may leak into the soil.

**Sustainable Development Goals**

**Sustainable Development Goal 2**

Although the topic at hand may seem like it does not have a direct cause and effect relationship with achieving the second sustainable development goal, a solution to this topic could be very valuable to solving world hunger. One of the most widespread uses of biotechnology is through the production of GMOs, and more specifically, GM crops. GM crops can be modified to be immune to diseases and to grow faster, which can help the quick and effective cultivation of crops to feed more people around the world. Furthermore, since GM crops have been proposed as a solution to eradicate hunger, in order to maintain sustainable development and achievement of this goal, such crops should have no side effects to the human body, and should not hurt the environment. Achieving biosafety in the age of biotechnology will ensure that the technology is sustainable.
One method of measuring the biosafety of modern biotechnology is through an assessment of how people’s health is affected through the use of biotechnology. Modern biotechnology also includes direct genetic modification and engineering like the CRISPR-Cas9 technology, which modifies a person’s genetic composition by editing a person’s genome by removing and adding parts of a person’s genetic sequence. Such advanced technologies seek to enhance human immunity or safety from certain diseases or physical impairments. Furthermore, if biotechnology has biosafety issues, it will inevitably hurt good health and well being with its side effects and hazards.

**Sustainable Development Goal 14, 15**

Sustainable development goals 14 and 15 seek to help protect life below water and life on land. Side effects or biosafety implications of biotechnology are directly related to the health and biodiversity of the environment as well as species on and below land. If biotechnology is used to enhance a certain specimen of organisms, but such modified organisms are released into the environment, the detrimental effects could damage or alter entire ecosystems, and thus the solution to biosafety will help achieve both sustainable development goals.

**Major Countries and Organizations Involved**

**International Center for Genetic Engineering and Biotechnology**

The International Centre for Genetic Engineering and Biotechnology ICGEB is an Intergovernmental Organisation within the United Nations Common System. The organization is one that organizes research, training, and seminars for scientists, technologists and engineers interested in application of biological materials for commercial use. It conducts extensive research in areas including, but not limited to infectious diseases, non-communicable diseases, medical biotechnology, industrial biotechnology,
and plant biotechnology. ICGEB’s Biosafety Group assists countries in their capacity to identify, regulate, manage and monitor products derived from modern biotechnology within their own jurisdiction.

**Biosafety Information Network and Advisory Services (BINAS)**

BINAS is a technical assistance service that helps governments in developing nations through assistance in the creation of biosafety regulations/guidelines. The networks are also a comprehensive data resource for biotechnology regulations, and methodologies for the assessment of biological risks arising from the development. Additionally, the organization handles the commercialization of genetically modified organisms and products though provisions of advanced training in biological risk assessment, genetic resource management and bioinformatics.

**United Nations Environment Programme (UNEP)**

The United Nations Environment Programme is a programme of the United Nations that helps assist member nations and their endeavors to protect the environment through implementing sound and effective environmental policies. The organization is related to the topic at hand since the greatest biosafety concerns regarding the development and application of modern biotechnology is its effects on the environment, the biodiversity, as well as on various organisms that compose the environment.

**International Organization for Biotechnology and Bioengineering (IOBB)**

IOBB is an intergovernmental organization that seeks to foster the advancement and exploitation of biotechnology and bioengineering for the benefit of mankind. It utilizes measures such as helping the cooperation between laboratories, research institutes, commercial organizations, and individuals to enhance the sharing of information through communication. The organization has worked in conjunction with UNESCO, MIRCENs, WFCC, UNEP, UNIDO, UNU, COBIOTECH and other international and national organizations to help achieve a solution to the issue of biosafety and development of biotechnology.

**Timeline of Events**

<table>
<thead>
<tr>
<th>Date</th>
<th>Description of event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1955</td>
<td>Dr. Jonas Salk develops the first polio vaccine with utilization of biotechnology</td>
</tr>
<tr>
<td>1977-1979</td>
<td>Development of biotechnology that helps produce human insulin and growth hormones</td>
</tr>
<tr>
<td>1988</td>
<td>The U.S. Congress funds the Human Genome Project, a massive effort to map and sequence the human genetic code as well as the genomes</td>
</tr>
</tbody>
</table>
1994 | The first genetically engineered tomato is approved by the FDA.

1986 | The first anticancer drug is produced with biotechnology.

1997 | The first artificial human chromosome is created.

2007 | Scientists discover how to use human skin cells to create embryonic stem cells.

2010 | Researchers at the J. Craig Venter Institute create the first synthetic cell.

**Relevant UN Treaties and Events**

- Cartagena Protocol on Biosafety to the Convention on Biological Diversity (Montreal, 29 January 2000)
- Nagoya-Kuala Lumpur Supplementary Protocol on Liability and Redress
- Resolution adopted by the General Assembly, Convention on Biological Diversity (A/RES/65/161)

**Possible Solutions**

One of the most significant methods of achieving improved biosafety in the modern age of biotechnology is through the improvement of GMO detection and monitoring. A report from the Food and Agriculture Organization under the United Nations observed that one of the most important areas that nations need assistance with is the detection and monitoring of GMOs, since many organizations and personnel in such nations lack technical information to deal with issues related to GMOs due to the lack of monitoring and detection.

The report also outlines that current regulations and policies devised by nations and organizations are in line with the Cartagena protocol, but still have many rooms for improvement. FAO outlines that the development of an effective coordination mechanism, involving the main stakeholders and ensuring coordination of roles and responsibilities among the relevant authorities is necessary to promote the effective and transparent regulation of biotechnology. Furthermore, national policies on biosecurity must outline clear goals and guidelines, since such guidelines become the basis for the development of a robust national regulatory regime and related institutional setting.

Finally, and most importantly, yet most intuitively, because modern biotechnology is imperfect, robust research and development must be conducted to reduce the side effects of biotechnology. The
biosafety concerns that are outlined in the background information section must be addressed, and solutions should focus on how to achieve biosafety through enhanced cooperation between NGOs, IGOs, and profit-seeking organizations that commercially use biotechnology. Without the cooperation of all relevant stakeholders in conducting the research, it will be impossible to regulate the utilization of biotechnology effectively, and if such research is only confined to certain organizations or nations, the solution would not be able to assist those without such research. The same applies to less economically developed nations that don’t necessarily have access to such research. Solutions should grant all peoples and entities access to essential information and technology that prevents biosafety hazards in biotechnology.

Bibliography


“ICGEB.” *ICGEB*, www.icgeb.org/.


**Appendix or Appendices**

I. **Cartagena Protocol on Biosafety to the Convention on Biological Diversity**

II. **Nagoya-Kuala Lumpur Supplementary Protocol on Liability and Redress**
   [https://bch.cbd.int/protocol/NKL_text.shtml](https://bch.cbd.int/protocol/NKL_text.shtml)

III. **A/RES/65/161**